



# Water Temperature in the Columbia and Snake Rivers

## Problem Description

# **Water Quality Standards**

**Colville Confederated Tribes**

**Idaho**

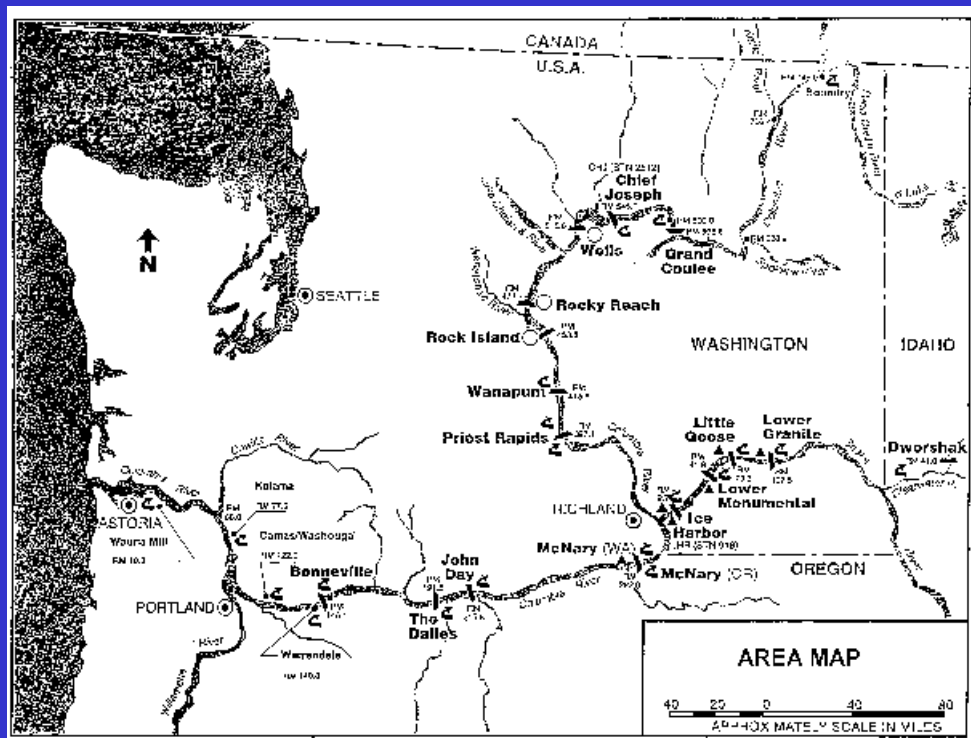
**Oregon**

**Washington**

C O L U M B I A  R I V E R	Canadian Border	Temperature shall not exceed <u>16</u> Degrees C due to human activities.	WA and Colville WQS
	Grand Coulee Dam	Temperature shall not exceed <u>18</u> Degrees C due to human activities.	WA WQS
	Priest Rapids Dam	Temperature shall not exceed <u>20</u> Degrees C due to human activities.	WA WQS
	OR/WA Border	Temperature shall not exceed <u>20</u> Degrees C due to human activities.	WA WQS
	Pacific Ocean	No measurable surface water temperature increase resulting from anthropogenic activities is allowed when temperatures exceed 20 degrees centigrade (7 day running average of the daily maximums)	OR WQS

S N A K E	Salmon River	22 Degrees C Maximum 19 Degrees C Daily Average	ID WQS
		No measurable surface water temperature increase resulting from anthropogenic activities is allowed when temperatures exceed 17.8 degrees centigrade from July 1 to Sept 30 and 12.8 Degrees C from Oct 1 to June 30.	OR WQS
R I V E R	OR/WA/ID Border	22 Degrees C Maximum 19 Degrees C Daily Average	ID WQS
		Temperature shall not exceed 20 Degrees C due to human activities.	WA WQS
	WA/ID Border		
	Columbia River	Temperature shall not exceed 20 Degrees C due to human Activities.	WA WQS

## Area Map



Does water temperature in the Columbia and Snake Rivers exceed Water Quality Standards?

## **Existing Data**

**McKenzie and Laenen (1998) assembled temperature data from 84 stations along the Columbia and Snake Rivers within the study area.**

**They collected data from all the dams, many USGS stations and a number of other stations.**

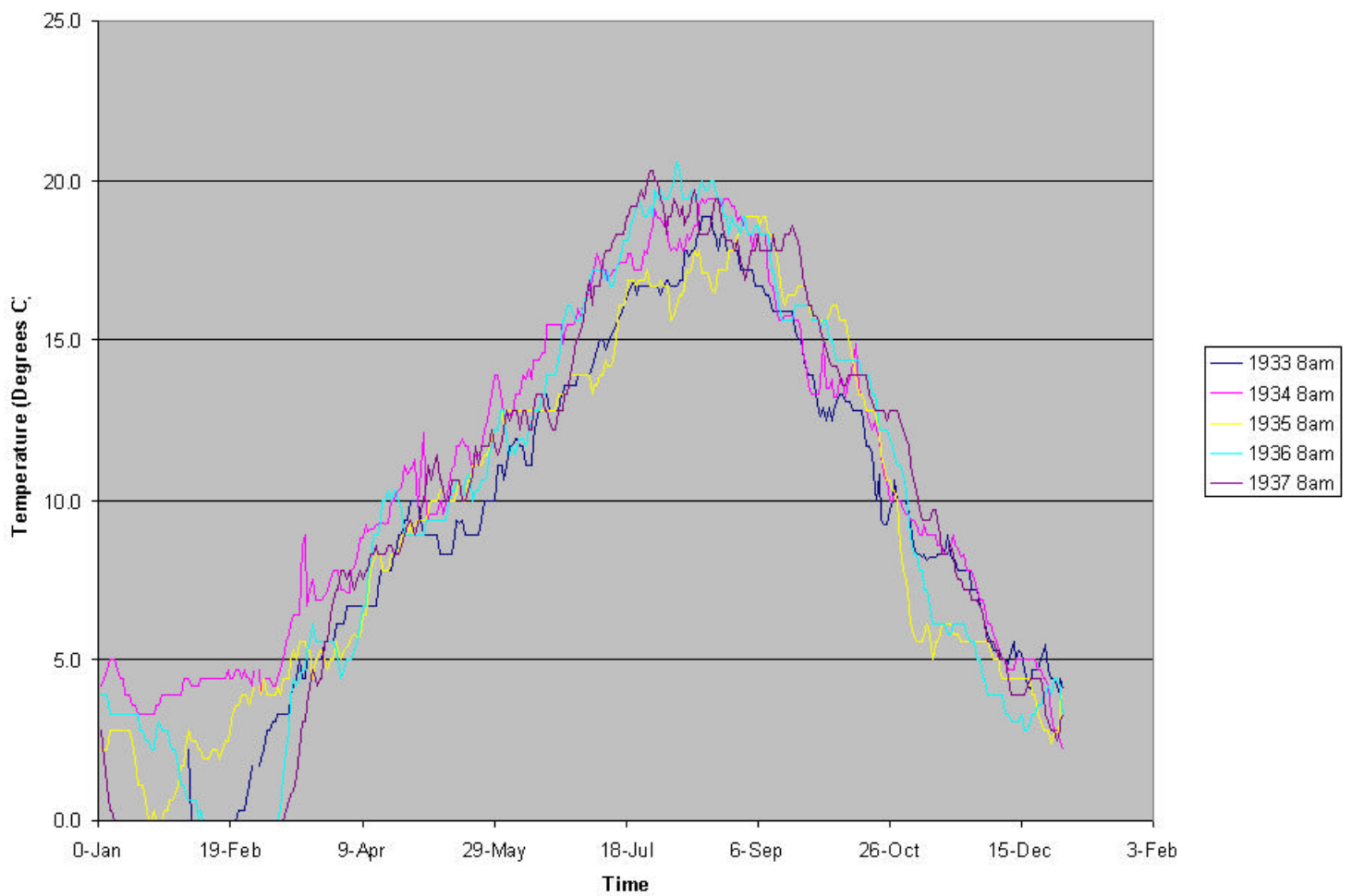
**Rock Island Dam data dates to 1933.**

**Bonneville Dam data dates to 1938.**

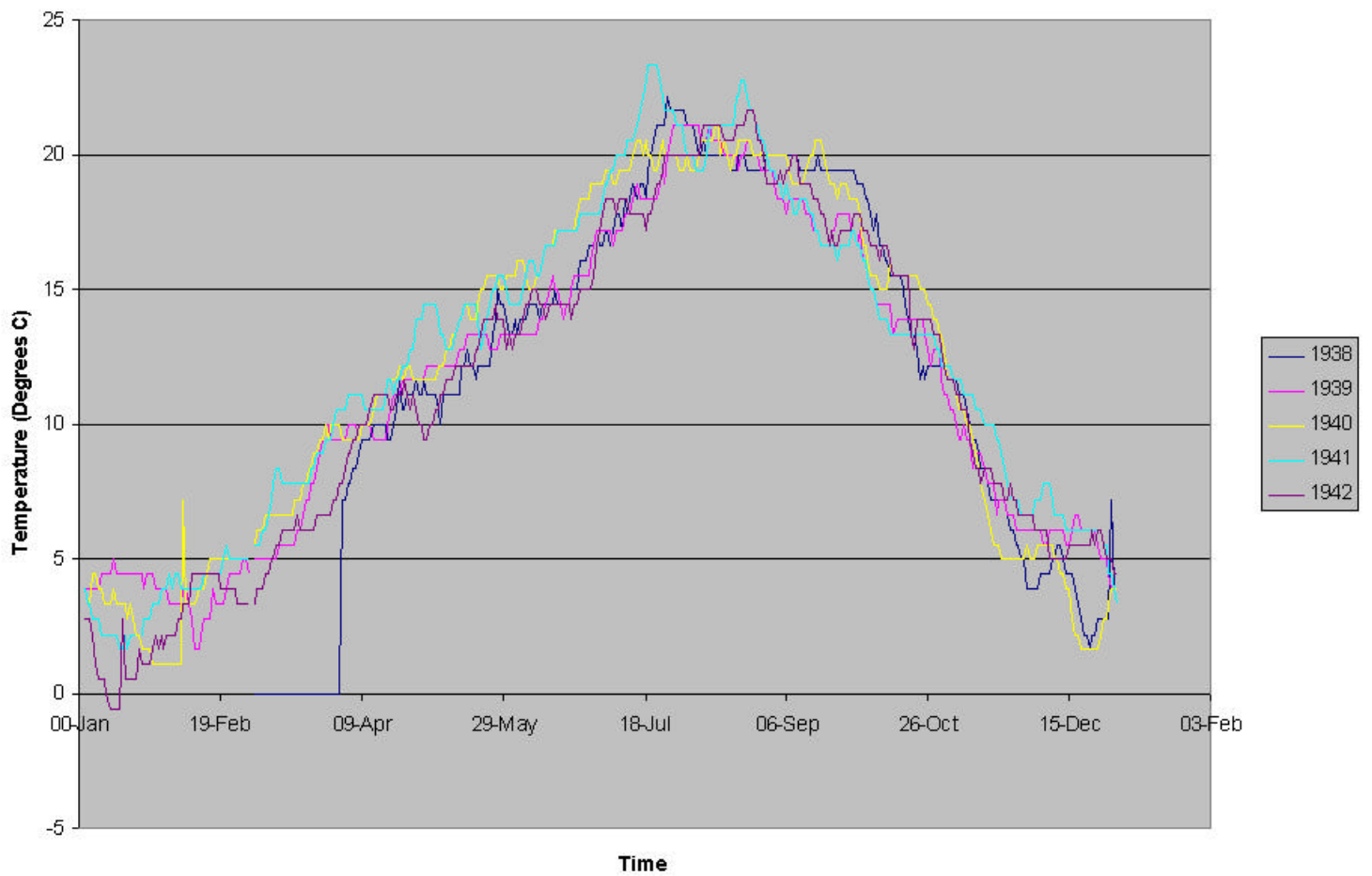
Location	Exceeds Water Quality Criterion		Record Length
	Frequency	Magnitude	
Lower Granite Dam	0.15	2.04	5/30/88-9/17/96
Little Goose Dam	0.15	2.49	5/30/88-9/16/96
Lower Monumental Dam	0.18	2.10	5/29/88-9/17/96
Ice Harbor Dam	0.18	2.35	5/29/88-9/23/96
Wells Dam	0.10	0.87	4/18/93-9/2/97
Priest Rapids Dam	0.18	1.61	4/28/88-12/31/97
McNary Dam	0.17	1.65	4/2/85-12/31/97
John Day Dam	0.15	1.65	4/17/84-9/16/97
Bonneville Dam	0.14	1.39	4/3/86-11/2/97



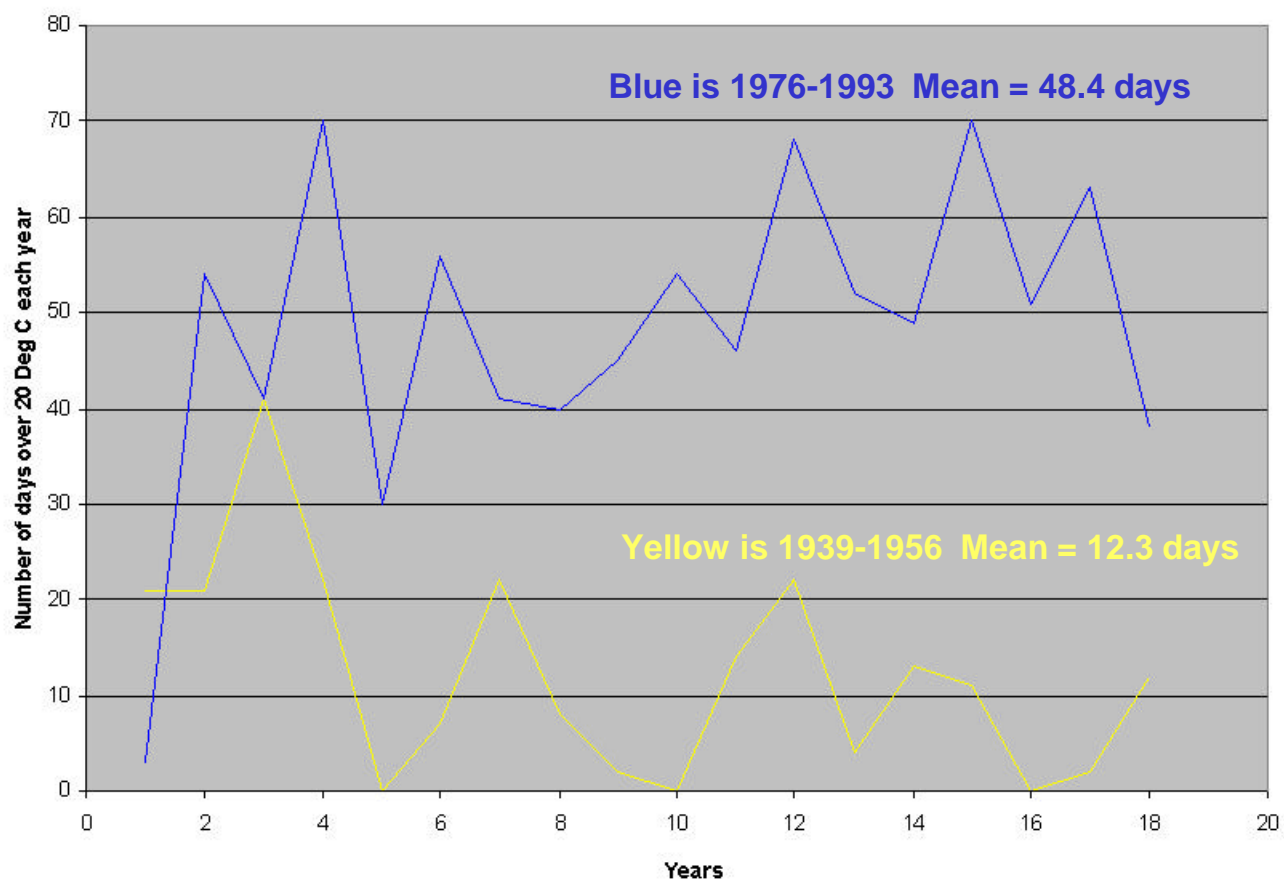
Temperature at the Rock Island Dam Scroll Case 1933 - 1937



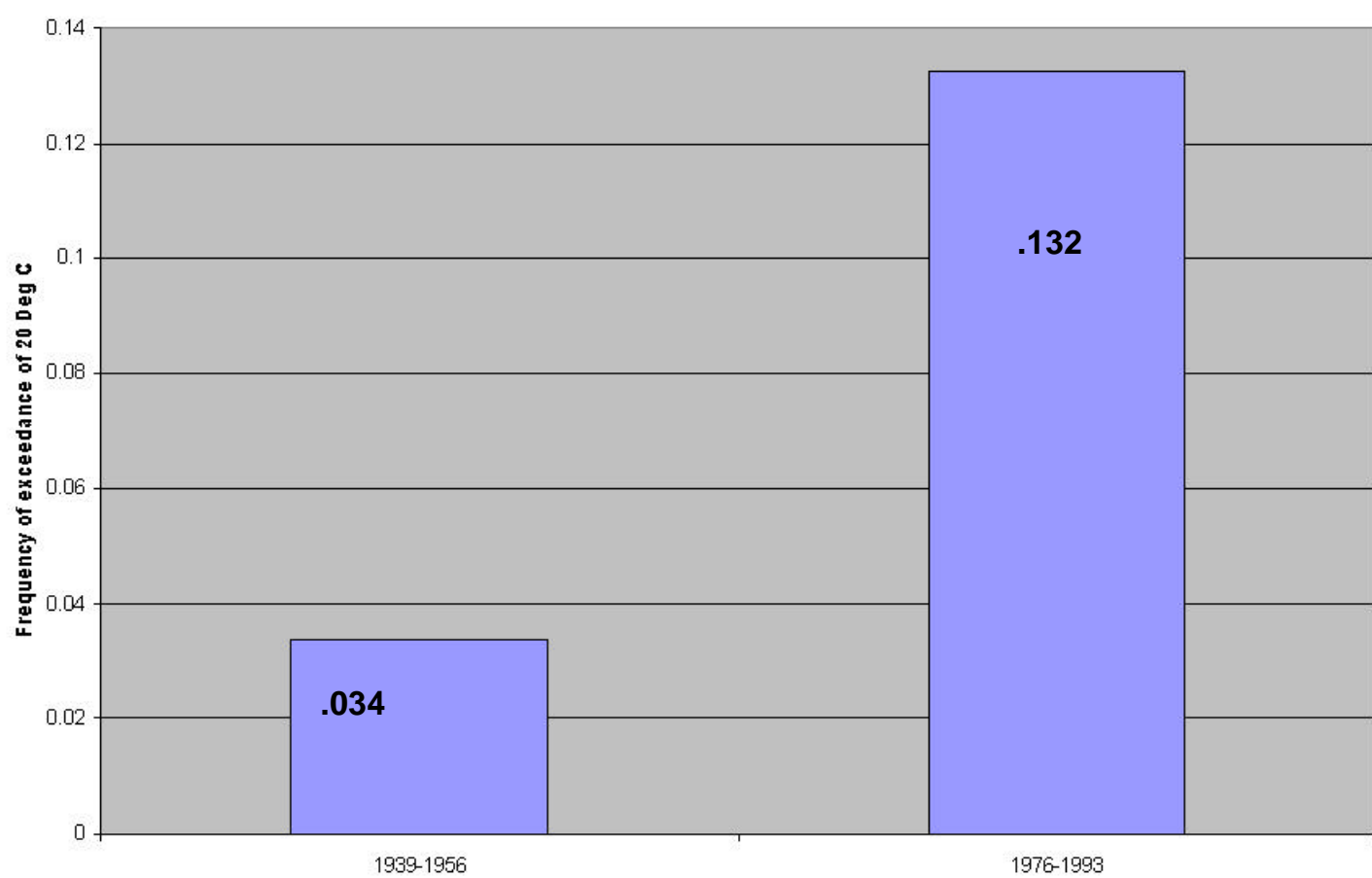
Water Temperature at Bonneville Dam 1938 - 1942



Number of Days that Exceed 20 Deg C at Bonneville Dam: Comparison of the two periods  
1939-1956 and 1976-1993



**Frequency of Exceedance of 20 C at Bonneville Dam for the 2 periods 1939-1956 and 1976-1993**



## **How has the Temperature Regime of the River Changed?**

- **Longer periods with temperatures in the warm range for coldwater biota;**
- **Temperature gradients in the reservoirs resulting in warm surface water;**
- **Less fluctuation in temperature - daily and in response to meteorology.**
- **Loss of cold water refugia due to flooding of the alluvial flood plains.**

## Effects of Temperature on Juvenile Steelhead

<u>Temp (C)</u>	<u>Effect</u>	<u>Reference</u>
12-13	Upper Limit of Optimal Range	Bell 1986
13	Smolting Inhibited	Zaug et al. 1972
15	Ability to out migrate reduced	Wedemeyer et al. 1980
	Fish stay in freshwater	McCullough 1999
16-17	Disease starts to be a concern	
	<i>Aeromonas liquefaciens</i>	Fryer & Pilcher 1974
	<i>A. salmonicida</i>	Fryer et al. 1976
	<i>Flexibacter columnaris</i>	Holt et al. 1975
19-20	Growth rate declines	Myrick & Cech 2001 (Rainbow Trout)

## Effects of Temperature on Juvenile Steelhead

<u>Temp (C)</u>	<u>Effect</u>	<u>Reference</u>
20-21	Predation, optimum range for northern pikeminnow	Vigg & Burley 1991
	walleye	Vigg et al. 1991
	smallmouth bass	Brown and Moyle 1981
	channel catfish	Koenst & Smith 1976
23	Disease more of a concern	Bell 1986
	Lethal range	(same as previous slide)
		Bell 1986